

**CLAIMS**

We claim:

1           1. A photovoltaic device adapted for performing biological operations  
2 comprising:

3           a) a photovoltaic semiconductor chip, which comprises a photovoltaic  
4 semiconductor substrate, having a first side and a second side opposite the first side, and at least  
5 one microlocation formed by at least one metallic film disposed on the first side of the substrate  
6 to receive a solution comprising a biological sample;

7           b) a light source for providing photovoltaic energy to the microlocation and to  
8 subject the solution to an electrophoretic force.

1           2. The photovoltaic device of claim 1 wherein the microlocations on the  
2 photovoltaic semiconductor chip are arranged in an array and are isolated from each other by a  
3 dielectric material.

1           3. The photovoltaic device of claim 2 wherein the dielectric material is  $\text{SiO}_2$ .

1           4. The photovoltaic device of claim 1 wherein the second side of the  
2 substrate is coated with a metal film to effect stringency on the solution at the microlocation.

1           5. The photovoltaic device of claim 4 wherein the metal film is selected from  
2 the group consisting of gold, aluminum, titanium, nickel, chrome, platinum, and alloys thereof.

1                   6.     The photovoltaic device of claim 1 further comprising a plate transparent  
2 to light and disposed on the microlocation to form a chamber.

1                   7.     The photovoltaic device of claim 6 wherein the plate is glass, quartz or  
2 sapphire.

1                   8.     The photovoltaic device of claim 6 wherein the plate is coated on the  
2 surface facing the microlocation with a transparent conductive thin film.

1                   9.     The photovoltaic device of claim 6 wherein the transparent conductive  
2 thin film is selected from the group consisting of indium tin oxide, indium oxide, tin oxide  
3 cadmium oxide, cadmium stannate and zinc stannate.

1                   10.    The photovoltaic devices of claim 1 wherein metallic layers are deposited  
2 on two opposite sides of the microlocation.

1                   11.    The photovoltaic device of claim 10 wherein the metallic layers comprises  
2 material selected from the group consisting of gold, aluminum, titanium, nickel, chrome,  
3 platinum, and alloys thereof.

1                   12.    The photovoltaic device of claim 1 further comprising a permeation layer  
2 disposed adjacent to the metallic film.

1                   13.    The photovoltaic device of claim 1 further comprising at least one lens  
2 between the light source and the microlocation to focus the light from the light source onto at  
3 least one microlocation.

1                   14.    The photovoltaic device of claim 13 where the light is focused on the side  
2    of the microlocation that receives the solution comprising the biological sample.

1                   15.    The photovoltaic device of claim 13 where the light is focused on the side  
2    of the microlocation opposite of the side of the microlocation that receives the solution  
3    comprising the biological sample.

1                   16.    A method of facilitating a biological operation comprising the steps of:  
2    immobilizing a first biological species on the surface of a microlocation of a photovoltaic device  
3    of claim 1;  
4                   placing a solution comprising a second charged biological species into the  
5    microlocation; and  
6                   exposing the microlocation to light to create an electrophoretic force to move the  
7    charged second biological species toward the immobilized first biological species.

1                   17.    The method of claim 16, wherein the biological operation is selected from  
2    the group consisting of nucleic acid hybridization and antibody/antigen reaction.

1                   18.    The method of claim 16 further including the step of:  
2                   applying a voltage to the photovoltaic device to subject the solution to a second  
3    electrophoretic force to effect stringency on the solution at the microlocation.